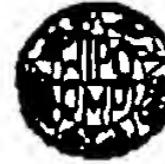


PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> :  D21H 21/14		A1	(11) International Publication Number: <b>WO 95/27825</b>  (43) International Publication Date: 19 October 1995 (19.10.95)
(21) International Application Number: PCT/KR94/00171 (22) International Filing Date: 25 November 1994 (25.11.94)  (30) Priority Data: 1994-7591 12 April 1994 (12.04.94) KR		(81) Designated States: AU, CA, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  Published <b>2187757</b> <i>With international search report.</i>	
(71) Applicant: KOREA RESEARCH INSTITUTE OF CHEMICAL TECHNOLOGY (KR/KR); 100, Jang-dong, Yusong-gu, Daejeon 305-343 (KR).  (72) Inventors: OW, Steven, Say-Kyoun; 103-902, Clover Apartment, Doonsan-dong, Seo-ku, Daejeon 302-173 (KR). SOHN, Chang, Man; 110-1806, Hanwool Apartment, Sinsung-dong, Yoosung-ku, Daejeon 305-345 (KR). HAN, Sin, Ho; 52-3, Juk-dong, Yoosung-ku, Daejeon 305-328 (KR). SHIN, Jong, Ho; 110-1502, Hanwool Apartment, Sinsung-dong, Yoosung-ku, Daejeon 305-345 (KR).  (74) Agent: YIE, Don, Sang; New Seoul Building, Room No. 301, 828-8 Yeoksam-dong, Gangnam-gu, Seoul 135-080 (KR).			
(54) Title: PREPARATION PROCESS OF PAPER FOR INCREASING FILLER CONTENTS AND ENHANCING SCOTT INTERNAL BOND STRENGTH			
(57) Abstract  Disclosed is a preparation process of paper for increasing the contents of the inorganic fillers in the paper and enhancing Scott internal bond strength. Additional to a conventional preparation process of paper, as a cellulase type enzyme, an enzyme produced by <i>Trichoderma longibrachiatum</i> which has a carboxymethylcellulase activity of 3,600 U/ml or more is added to a pulp in an amount of 0.01 ~ 0.2 % by weight based on the weight of the wood pulp. The contents of fillers in the paper is increased and Scott internal bond strength is enhanced.			

WO 95/27825

2187757

PCT/KR94/00171

PREPARATION PROCESS OF PAPER FOR INCREASING FILLER CONTENTS  
AND ENHANCING SCOTT INTERNAL BOND STRENGTH

Technical Field

The present invention relates to a preparation process of a  
5 paper for increasing the contents of inorganic fillers in the  
paper while maintaining the internal bond strength of the paper.  
The present invention further relates to a preparation process of  
paper wherein a wood pulp is treated with a cellulase-type enzyme  
for beating to thereby improve the paper strength, particularly  
10 the internal bond strength so that the filler contents of paper  
can be increased as much as the increased amount of the internal  
bond strength. As a result a paper having a large amount of  
fillers while maintaining an internal bond strength thereof can  
be prepared.

15 Background Art

Generally, a printing paper is prepared by mixing a beaten  
wood pulp with inorganic fillers and then adding at least one  
cohesive agent. As fillers for paper production, talc, calcium  
carbonate, titanium dioxide etc. can be used.

20 A portion of pulp can be replaced with a filler to save the  
production cost of the paper and the brightness, the opacity, the  
smoothness and printability of the paper can be improved.  
Therefore, addition of a filler into paper is preferable.

However, when a large amount of a filler is added into the  
25 pulp, since the fillers weaken the intermolecular binding force  
of the pulp, the physical and mechanical properties of the pulp  
deteriorate. Further, during the drainage process of the pulp  
fibers on the wires of a paper machine, the fillers pass through  
the wires and the fillers retention in paper decreases. The  
30 wires are severely abraded and therefore the load for circulation  
of white water and water drain is increased, which is unpre-  
ferable.

Disclosure of the Invention

Therefore, it is an objective of the present invention to  
35 provide a preparation process of paper wherein the contents of the  
inorganic fillers included in the paper is increased while main-

WO 95/27825

PCT/KR94/00171

2187757

-taining the internal bond strength thereof.

In accordance with the present invention, a cellulase-type enzyme is added to a pulper and the pulp is disintegrated. Then, this pulp is treated for beating and processed for paper making.

5 At this time, due to an activity of the cellulase type enzyme on the pulp fiber, the surface area of the fiber is increased. As a result, the bond force between the fibers is increased to thereby enhance the internal bond force of the paper.

#### Best Modes for carrying out the invention

10 In accordance with a preparation process of paper, a cellulase-type enzyme is added to a pulper to dissolve the pulp and then the pulp is beated for a preparation of paper.

The cellulase type enzyme is added to the pulper in amount of 0.01 ~ 0.2% by weight based on the weight of the wood pulp, 15 thereby disintegrating the wood pulp and then beating the wood pulp. At this time, as a cellulase type enzyme, an enzyme produced by *Trichoderma longibrachiatum* which has a carboxymethyl-cellulose activity of 3,600U/ml or more, is preferably used.

When the beated wood pulp is processed for the preparation 20 of paper in the same manner as a conventional process, the cellulase-type enzyme activates the surface of the pulp fiber of thereby increase the surface area of the fiber. Therefore, the binding between the fibers is improved to increase the internal bond strength of paper. Therefore, the contents of the filler 25 can be increased as much as the increased amount of the internal binding force.

The preparation process of paper according to the present invention will be explained in detail hereinafter.

Bleached chemical wood pulp and 0.01 ~ 0.2% by weight(based 30 on the weight of the wood pulp)of a cellulase type enzyme having a carboxymethylcellulase activity of 3,600U/ml or more are simultaneously introduced into a pulper. At this time, the dissolving temperature is maintained between 35 ~ 45°C and pH of 4.0 ~ 6.8.

35 Under these conditions, the pulp is disintegrated for 15 ~ 20 minutes and then beated using a refiner so as to have a suit-

WO 95/27825

PCT/KR94/00171

2187757

ble beating degree. The pulp stock thus prepared in this manner is transferred to the paper machine for paper making. The cellulase type enzyme activates the surface of the pulp fiber to increase the surface area of the fiber. As a result, the 5 strength of paper, especially the internal bond strength is remarkably increased.

In a conventional process, a large amount of fillers can not be included in the paper since the fillers deteriorate the physical properties of the paper. However, in the present 10 invention, due to the using an enzymatic treatment, the internal bond strength is increased and therefore the contents of fillers may be increased as much as the increased amount of the internal bond strength.

15 The paper prepared in accordance with the present invention as explained above has following properties when compared with that prepared in accordance with a conventional process.

- ① The beating power consumption of can be reduced.
- ② When having the same amount of fillers, the internal bond strength is improved.
- 20 ③ When having the same internal bond strength, the absolute contents of fillers can be increased by up to 5% by weight.
- ④ As a large amount of fillers is included in the paper, the drying power consumption of the paper can be reduced.

25 Hereinafter, the present invention will be explained in detail with reference to the following examples.

#### Example 1

A pulp stock was prepared to have the composition as shown in table 1 as below.

WO 95/27825

PCT/KR94/00171

2187757

Table 1

	Components	Composition rate (% by weight)
5	Bleached chemical pulp of needle-leaf trees	85
	Bleached chemical pulp of broad-leaf trees	15
10	Retention enhancing agent	0.05 *
15	Fillers	15 **
	Talc	15 **
15	Paper strength enhancing agent	0.5 *

\* Composition ratio based on the weight of the produced paper.

\*\* Composition ratio based on the weight of the pulp.

Using the composition ratio as shown in table 1, as a cellulase-type enzyme an enzyme produced by *Trichoderma longibrachiatum* having a carboxymethyl-cellulase activity of 3,600U/ml or more was introduced into a pulper in an amount of 0.02% by weight based on the pulp while maintaining a temperature of about 40°C and pH of 4.0 ~ 6.8.

Under the above conditions, after dissolving the pulp stock for 15 minutes, the pulp stock was beaten to a predetermined beating degree, to prepare a hand sheet having 80g/m<sup>2</sup> basis weight, which was conditioned at a constant humidity of 49 ~ 51% and at a temperature of 22 ~ 24°C. Thereafter, ash contents and Scott internal bond strength of the paper were measured.

WO 95/27825

2187757

PCT/KR94/00171

The results are shown in Table 2.

**Comparative Example 1**

In order to compare the preparation process of paper according to the present invention and a conventional preparation process of paper, a paper was prepared in the same manner as in Example 1 except that an enzyme was not introduced into the pulper. Ash contents and Scott internal bond strength of the paper were measured. The results are shown in Table 2.

**Example 2**

10 A paper was prepared in the same manner as in Example 1 except that the enzyme was introduced in the pulper in an amount of 0.1% by weight. Ash contents and Scott internal bond strength were measured and the results are shown in Table 2.

**Example 3**

15 A paper was prepared in the same manner as in Example 1 except that the enzyme was introduced in the pulper in an amount of 0.2% by weight. Ash contents and Scott internal bond strength were measured and the results are shown in Table 2.

**Example 4**

20 A paper was prepared in the same manner as in Example 1 except that the enzyme was introduced into the pulper in an amount of 0.1% by weight and that calcium carbonate and talc were added in an amount of 20% each by weight respectively. Ash contents and Scott internal bond strength were measured. The 25 results are shown in Table 2.

Table 2

	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Comparative Example 1
30 Ash contents (% by weight)	20.2	20.3	20.3	24.9	20.1
Scott internal bond strength	149	167	173	135	134

WO 95/27825

2187757

PCT/KR94/00171

As can be seen from the above, the paper prepared according to the present invention has an increased internal bond strength at the same amount of ash contents when compared to a paper prepared according to a conventional process. Further, Scott 5 internal bond strength is remained at the same level as the conventional process in spite of an increased amount of inorganic fillers.

Therefore, the paper prepared according to the present invention maintains an internal binding strength which is one of 10 most important characteristics for a coating base paper, a printing paper and a photocopy paper in spite of an increased amount of an inorganic filler contained in the paper. Further, as the amount of the enzyme is increased, the internal bond strength is enhanced. The amount of a pulp material can be saved 15 as much as the increased amount of the fillers.

WO 95/27825

2187757

PCT/KR94/00171

## Claims

1. A preparation process of a paper containing an inorganic filler for a base paper of coating paper a printing paper and a copying paper characterized in that an cellulase type enzyme is added to a paper material having said inorganic filler in a 5 pulper so that a content of the inorganic filler is increased and an internal bond strength of the paper is enhanced.
2. The preparation process as claimed in claim 1, wherein said cellulase type enzyme is a *Trichoderma* species.
3. The preparation process as claimed in claim 2, wherein 10 said cellulase type enzyme is an enzyme having a carboxymethyl-cellulase activity of 3,600U/ml or more produced by *Trichoderma longibrachiatum*.
4. The preparation process as claimed in claim 1, wherein said cellulase type enzyme is added in an amount of 0.01 ~ 0.2% 15 by weight based on a weight of wood pulp.
5. The preparation process as claimed in claim 1, wherein said inorganic filler is at least one selected from the group consisting of talc, calcium carbonate and titanium dioxide.
6. The preparation process as claimed in claim 1, wherein 20 said inorganic filler is contained in an amount of 30 ~ 40% by weight.

**Sorry, there are no drawings for patent number 2187757.**

© *Her Majesty the Queen in Right of Canada, 1999*

**Canada**  
<http://strategis.ic.gc.ca>